

DETAILED ACTION

It was brought to the Examiner's attention by Mr. Andrew Griffis that the Office Action mailed 6/26/2008 was based upon originally presented claims instead of amended claims filed with the application. This Office Action corrects the error and the response time period has been reset. The Examiner regrets the error.

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 8 and 9 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 8, which depends from claim 1, recites a "diluent." However, it is not clear where the diluent component is optional or required in either or both of oligomerization and alkylation.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1, 5, 10, 11, 14, and 19 are rejected under 35 U.S.C. 102(b) as anticipated by Applicants' submitted NPL to Cavani et al, entitled "Effect of Water in the Performance of the Solid Phosphoric Acid Catalyst for Alkylation of Benzene to Cumene and for Oligomerization of Propene" (hereinafter "Cavani").

Cavani discloses the importance of water content in feedstock for both alkylation and oligomerization applications in the presence of a solid phosphoric acid catalyst. The water content in the reactor inlet essentially depends on the moisture content of the fresh feedstock (therefore on its temperature and composition), on the presence of some pretreatments of the feedstock itself, on the amount of recycled feed, as well as on the amount of injected water in the feed stream. A certain amount of water is necessary to maintain the Bronsted acidity of the catalyst. Under typical industrial operation the water content in the reactor inlet can range from 100 to 1000 wt. ppm in the case of propylene oligomerization and from 50 to 300 ppm in the case of cumene synthesis. When water in the feedstock is not strictly controlled, it has an effect on the productivity as well as the purity of the product. Furthermore, the overall life of the catalyst can be improved by an accurate control of the water content. See page 178, paragraph 4 to page 179, paragraph 1. Cavani conducted experimental tests where the water content of the feedstream was measured with an online moisture analyzer from Panametrics (page 179, paragraph 2 to page 180, paragraph 4). From the results of the experimental tests, Cavani discloses that the best operating conditions are dictated by the type of application. Cavani further discloses drying pretreatment of the feedstock may be appropriate where the feedstock contains higher than required water content.

See page 193, paragraph 1. Cavani, also, discloses using multitubular reactors (page 180, paragraph 4) and chamber reactors (page 194, 1st paragraph).

It is noted that claim 1 recites "wherein the water content of the feed is greater during the initial phase of the process than at the latter phase of the process." This limitation is met by Cavani's disclosure of "drying pretreatment of the feedstock" where the feedstock contains higher than required water content. The pretreatment step is a part of "the process."

Thus, each and every limitation of claims 1, 5, 10, 11, 14, and 19 are anticipated by Cavani.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 2-4, 6-9, 12, 13, 15-18, and 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Applicants' submitted NPL to Cavani et al, entitled "Effect of Water in the Performance of the Solid Phosphoric Acid Catalyst for Alkylation of Benzene to Cumene and for Oligomerization of Propene" (hereinafter "Cavani") in view of WO 93/16020 (hereinafter "WO").

Cavani discloses the importance of water content in feedstock for both alkylation and oligomerization applications in the presence of a solid phosphoric acid catalyst. The water content in the reactor inlet essentially depends on the moisture content of the fresh feedstock (therefore on its temperature and composition), on the presence of some pretreatments of the feedstock itself, on the amount of recycled feed, as well as on the amount of injected water in the feed stream. A certain amount of water is necessary to maintain the Bronsted acidity of the catalyst. Under typical industrial operation the water content in the reactor inlet can range from 100 to 1000 wt. ppm in the case of propylene oligomerization and from 50 to 300 ppm in the case of cumene

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synthesis. When water in the feedstock is not strictly controlled, it has an effect on the productivity as well as the purity of the product. Furthermore, the overall life of the catalyst can be improved by an accurate control of the water content. See page 178, paragraph 4 to page 179, paragraph 1. Cavani conducted experimental tests where the water content of the feedstream was measured with an online moisture analyzer from Panametrics (page 179, paragraph 2 to page 180, paragraph 4). From the results of the experimental tests, Cavani discloses that the best operating conditions are dictated by the type of application. Cavani further discloses drying pretreatment of the feedstock may be appropriate where the feedstock contains higher than required water content. See page 193, paragraph 1. Cavani, also, discloses using multitubular reactors (page 180, paragraph 4) and chamber reactors (page 194, 1st paragraph).

Cavani fails to disclose automatically controlling the water content of the feed according to an analysis of the composition of the feed.

However, in view of Cavani's disclosure of the criticality of controlling water in the feedstock relative to productivity as well as purity of the product, it would have been obvious to one skilled in the art at the time the invention was made to have modified the process of Cavani by including a means to automatically control the level of water in the feed composition to obtain and maintain high productivity and purity of a desired product.

With regard to the limitation of using water wash, it would have been obvious to employ water from variety of sources including within the process means, i.e., water wash.

With regard to the limitation of separating unreacted olefins from the conversion products and recycling the separated unreacted olefins, it would have been obvious to a one having ordinary skill in the art to separate unconverted reactants from the product and recycle the separated unconverted reactants for a more efficient and economical process.

The WO reference discloses a process for oligomerization of C₂-C₁₂ alkene containing feedstock having a water content of 0.054 to 0.25 molar % to produce C₅ to C₂₀ olefins (page 3, lines 9-20). Any known zeolite catalyst which is active in alkene oligomerization may be employed (page 4, lines 20-35). The reaction conditions include a temperature not exceeding 260° C (page 4, lines 4-7).

With regard to the limitation of oligomerization of a mixture of C₃ and C₄ olefins and a catalyst comprising a zeolite, it would have been obvious to one skilled in the art to have modified the process of Cavani and included oligomerization of a mixture of C₃ and C₄ olefins as disclosed by WO (page 12, lines 28-37) because WO discloses a similar oligomerization process including the criticality of having a feed containing water. Also, like Cavani, WO recognizes the advantages of using zeolites over a solid phosphoric acid catalyst. Furthermore, WO explicitly discloses using zeolites in the oligomerization of alkenes and the affect of including water in the process which extends the life of the zeolite catalysts. Therefore, it is within the level of one having ordinary skill in the art to have modified the process of Cavani by employing zeolites in the oligomerization process due to the advantages of using zeolites over a solid phosphoric acid as taught by WO (see page 1, lines 10-14).

With regard to the claimed step of purifying the conversion products including the step of desulphurization, it would have been obvious to one skilled in the art to have purified the conversion product for subsequent downstream processing to obtain a more efficient and improved processing and higher yield of desired products.

With regard to the claimed conversion conditions including a temperature from about 200° to 300° C when the catalyst is a solid phosphoric acid, it would have been obvious to one having ordinary skill in the art to have determined the optimum conversion conditions including the claimed temperature range through routine experimentation in the absence of a showing of criticality. *In re Woodruff*, 16 USPQ2d 1934, 1936 (Fed. Cir. 1990).

Any inquiry concerning this communication or earlier communications from the examiner should be directed to In Suk Bullock whose telephone number is 571-272-5954. The examiner can normally be reached on Monday - Friday 6:00-2:30.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Glenn Caldarola can be reached on 571-272-1444. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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/In Suk Bullock/
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